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BOX PATENT APPLICATION
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Sir:

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Applicants: Peter Bohacek and David Sanders
Title: Interaction of VoIP Calls and Cellular Networks

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Enclosed are:
[X]   _13_ pages of specification and claims
[X]   _4_ sheets of informal drawings.

The filing fee has been calculated as shown below:

For	(Col. 1) No. Filed	(Col. 2) No. Extra	Small Entity		or	Other Than a Small Entity	
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Basic Fee				$345.00			$690.00
Total Claims	1 - 20 =*	0	x $9 =	$		x $18 =	$0.00
Indep. Claims	1 - 3 = *	0	x $39 =	$	or	x $78 =	$0.00
Multiple Dependent Claims Present [ ]			+ $130 =	$		+ $260 =	$0.00
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   [x]   Any patent application processing fees under 37 CFR § 1.17.
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Respectfully submitted,

Dated: _9/1/2000_

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1   **INTERACTION OF VoIP CALLS AND CELLULAR NETWORKS**

2

3   <u>CROSS-REFERENCE TO RELATED APPLICATIONS</u>

4

5   The present application is related to and claims benefit of the priority of the

6   following co-pending U.S. Provisional and Utility Patent Applications: "Dynamic

7   Forward Error Correction Algorithm for Internet Telephone," Serial Number 08/907,686,

8   filed on August 8, 1997, "System and Method for Real-Time Data and Voice

9   Transmission Over an Internet Network," Serial Number 09/130,896, filed on August 7,

10 1998, and "Interaction of VoIP Calls and Cellular Networks," Serial Number 60/152,039,

11 filed on September 2, 1999, which are hereby incorporated by reference.

12

13   <u>BACKGROUND OF THE INVENTION</u>

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15 1.   <u>Field of the Invention</u>

16   This invention relates generally to telephone communications, and more

17 particularly to telephoning via Voice-over-IP (VoIP) and wireless networks.

18

19 2.   <u>Description of the Background Art</u>

20   FIG. 1 shows a prior art telephony system 100 that includes a corporate network

21 120, a traditional Public Switched Telephone Network (PSTN) 140, and a wireless

22 network 160. System 100 routes a communication 124 from a Caller 122 in corporate

23 network 120 to a wireless network Subscriber 190.

1   The corporate network 120 includes a traditional Private Branch Exchange (PBX)

2   128. The PSTN 140 includes a Local Exchange Carrier (LEC) 144, which in turn

3   includes a Central Office (CO) 148. PBX 128, which receives communication 124 from

4   Caller 122, establishes connection 130 to Central Office (CO) 148, which in turn

5   establishes connection 150 to wireless network 160. Those skilled in the art will

6   recognize that, instead of communication 124, a comparable communication may also be

7   initiated by a direct telephone call from a home telephone (not shown). Passing through

8   PBX 128, in addition, PSTN 140 may be replaced by an Integrated Services Digital

9   Network (ISDN).

10   Wireless network 160 includes a Gateway Mobile Switching Center (GMSC) 164,

11   a Home Location Register (HLR) 166, and a Visited Mobile Switching Center (VMSC)

12   168. GMSC 164, communicating via connection 171 with a base station (BS) 165 within

13   Subscriber 190's "home" wireless network 160, is the control element for managing

14   wireless network 160, and is responsible for switching cellular cells, providing for

15   backup, interfacing with telephone networks, and monitoring telephony traffic.

16   A wireless Subscriber 190 may "register" merely by turning on his or her cell-

17   phone. This example assumes that Subscriber 190 is currently registered and is not

18   currently engaged in a call. Upon establishment of connection 150 from CO 148, GMSC

19   164 via signal path 170 gathers information from HLR 166 to determine how to route

20   connection 150. Note that establishment of connection 150 may involve one or more

21   intermediate exchanges.

22

1   Wireless network 160 uses HLR 166 and VMSC 168 to locate Subscriber 190 and

2 thereby establish final wireless connection 180. Each Subscriber belongs to one HLR

3 166 associated with a cellular operator or a commercial network provider. HLR 166

4 stores information (accounting, subscribed services, profile information, etc.) about

5 Subscriber 190. HLR 166, via one of several (not shown) VMSCs (i.e. VMSC 168),

6 which report back on signal path 174, keeps track of the location of Subscriber 190.

7 VMSC 168 informs HLR 166 when Subscriber 190 is on the system of VMSC 168, and

8 HLR 166 in turn updates its profile record for the new location of Subscriber 190. When

9 a call is placed to Subscriber 190, HLR 166 determines whether Subscriber 190 is a valid

10 subscriber, and if so, which VMSC 168 is currently serving Subscriber 190.

11 Subsequently HLR 166, via signal path 172, requests routing instructions from VMSC

12 168 for Subscriber 190. VMSC 168, having received information about Subscriber 190

13 from HLR 166, assigns a routing number N for connection 150, and then returns this

14 routing number N via signal path 174 to HLR 166. The HLR 166 then returns the routing

15 number N via signal path 176 to GMSC 164. The GMSC 164 uses this routing number N

16 to establish connection 178 to VMSC 168. This step may involve one or more

17 intermediate exchanges and/or networks. Once connection 178 is established with the

18 VMSC 168, wireless connection 180 is completed to Subscriber 190 using standard

19 wireless call processing which is not described herein.

20   FIG. 2 shows a prior art system 200 comprising a corporate network 120 as in

21 system 100 of FIG. 1, a VoIP Virtual Private Network (VPN) 240, and a wireless

22 network 160 as in system 100 of FIG. 1. System 200 uses VPN 240 instead of PSTN 140

23 of system 100 to route a communication 124 from a Caller 122 to a wireless network

1   Subscriber 190. Connection 130 is established between PBX 128 and GW-1 242,

2   residing within the VoIP VPN 240.

3   VoIP VPN 240 includes a Command Center (CC) 244, a Gateway (GW-1) 242,

4   and a second Gateway (GW-2) 246. In the preferred embodiment of the invention, CC

5   244, GW-1 242, and GW-2 246 are command center and gateway products of Clarent

6   Corporation of Redwood City, California. In system 200, as in system 100, instead of

7   communication 124 passing through PBX 128, a comparable communication may also be

8   initiated by a direct telephone call from a home telephone.

9   The gateways GW-1 242 and GW-2 246 support an Internet Protocol (IP) such as

10   Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) connection via

11   the VoIP VPN 240 to the Internet (not shown). GW-1 242 and GW-2 246 support both

12   telephone-to-telephone communications and PC-to-telephone communications.

13   The originating exchange PBX 128 within the corporate network 120 (or possibly

14   a Central Office, not shown) determines that VPN 240 is on-net. GW-1 242 via signal

15   path 250 requests routing information from CC 244. CC 244 verifies that connection 230

16   is allowed and translates the called Subscriber 190's number into an IP address. CC 244

17   via signal path 252 notifies GW-2 246 about the incoming connection 258, and GW-2

18   246 via signal path 254 notifies CC 244 of its readiness to accept connection 258. CC

19   244 via signal path 256 returns the translated IP address to GW-1 242. GW-1 242

20   establishes connection 258 with GW-2 246. GW-2 246 continues routing based upon the

21   called Subscriber 290's number via path 262 to a GMSC 264 within the called Subscriber

22   190's home wireless network 160. This step may involve one or more intermediate

23   exchanges and/or networks.

1   From this point on, standard wireless call processing is used. The GMSC 164 via

2   signal path 170 queries HLR 166 containing the Subscriber 190's profile to determine

3   how to continue routing. This example assumes that the subscriber is registered and is

4   not currently engaged in a call. Registration may occur merely by Subscriber 190 turning

5   on his cell-phone. The HLR 166 determines that the Subscriber 190 is valid and

6   determines which VMSC 168 is currently serving him or her. HLR 166 via signal path

7   172 queries VMSC 168 for routing instructions. The VMSC 168 determines that

8   Subscriber 190 is registered within its service area and assigns a temporary routing

9   number N. VMSC 168 returns this temporary routing number N via signal path 174 to

10   HLR 166, which in turn returns temporary routing number N via signal path 176 to

11   GMSC 164. The GMSC 164 uses the temporary routing number N to route connection

12   178 to VMSC 168. This step may involve one or more intermediate exchanges and/or

13   networks. Once the connection is established with VMSC 168, wireless call 180 is

14   completed to Subscriber 190 using standard wireless call processing, which is not

15   described herein.

16   In both prior art systems 100 and 200, GMSC 164 is fixed in the home service

17   area of Subscriber 190. System 200 changes between using VMSCs 168 in different

18   locations based upon the location of Subscriber 190, and regardless of the subscriber's

19   location, connections are always routed to GMSC 164 before being transmitted to the

20   VMSC 168 closest to the subscriber, generally, and then to Subscriber 190. The GMSC

21   164 being fixed in the home service area for Subscriber 190 creates inefficiency. For

22   example, suppose Subscriber 190 has a home base in Los Angeles (LA), California, and

23   travels to San Francisco (SF), California, where Caller 122 resides. Consequently,

1 GMSC 164 is in LA (or some nearby locality) and VMSC 168 is in SF (or some nearby

2 locality). As Caller 122 uses either system 100 or 200 to call Subscriber 190, routing

3 must go from SF to GMSC 164 in LA, then to VMSC 168 in SF, and eventually to

4 Subscriber 190 in SF. As a result, even if Caller 122 and Subscriber 190 are in the same

5 locale of SF, routing must first go through LA before reaching Subscriber 190, who is in

6 SF. Further, in a traditional wireless call as depicted in system 100, Caller 122 would

7 incur two long distance toll charges, one from SF to LA, and one from LA back to SF.

8 Additionally, VoIP VPN 240 of system 200 loses control of routing. As

9 connection 262 leaves GW-2 246 and enters wireless network 160, the wireless network

10 160 assumes complete control of routing. Once the connection 262 is passed from VoIP

11 VPN 240 into the wireless network 160, a traditional toll call takes place, even though

12 Caller 124 and Subscriber 190 in this example are both located in SF. The VoIP VPN

13 240 eliminates the toll leg from SF to LA, but the wireless network 160 still creates a toll

14 call from GMSC 164 in LA to VMSC 168 in SF.

15 Moreover, in various situations, VoIP VPN 240 would benefit from maintaining

16 control of a call up to the connection 262 with VMSC 168 for providing additional call

17 completion services without being dependent upon wireless network 160.

18 What is needed, therefore, is a solution that can alleviate the above-discussed

19 deficiencies by eliminating possible and/or unnecessary toll calls.

SUMMARY OF THE INVENTION

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3   The present invention provides a system and method for improving current

4 telephony use of VoIP on a VPN to interact with a wireless network. The invention

5 efficiently routes telephone calls to wireless subscribers and allows a VoIP VPN system

6 to gain and maintain control of a call. The invention thereby extends capabilities of VoIP

7 VPN services to permit intelligent call completion even after a call has been routed to a

8 terminating wireless network or in the event that a wireless network subscriber cannot be

9 reached. The invention also eliminates toll calls associated with traditional wireless calls

10 and prior art VoIP VPN wireless calls.

11   In accordance with the invention, if a called party does not answer a call then the

12 calling party can control disposition of the call. Using the profile of the called party, the

13 invention may provide the following services/capabilities: a caller may route a call to the

14 called party's secretary, voice mail, pager or alternate destination; the system may

15 automatically route the call to the most likely location of the called party; the system,

16 based upon the identity of the calling party, may route the call to a specific location; and,

17 when a call is established, the called party may control further capabilities, such as

18 transferring the call or adding a third party, among other options.

1 <u>BRIEF DESCRIPTION OF THE DRAWINGS</u>

2 FIG. 1 is a block diagram showing a prior art system for a traditional wireless

3 telephone call;

4 FIG. 2 is a block diagram showing a prior art system for wireless telephone

5 calling using a VoIP Virtual Private Network;

6 FIG. 3 is a block diagram showing an improved system for wireless telephone

7 calling using a VoIP Virtual Private Network in accordance with the invention; and

8 FIG. 4 is a flowchart illustrating steps in a method for routing a call in accordance

9 with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

1

2

3   FIG. 3 shows a system 300 comprising corporate network 320, VoIP VPN 340,

4   and wireless network 360. In this scenario, corporate network 320 remains the same as

5   network 120 of FIG. 1 and of FIG. 2. However, element numbers are modified for FIG. 3

6   to aid in distinguishing elements related to the present invention. The VoIP VPN 340

7   product replaces the PSTN 140 of FIG. 1 and the VoIP VPN 240 of FIG. 2, and wireless

8   network 360 replaces the wireless network 160 of FIG. 1 and of FIG. 2. In accordance

9   with the invention, system 300 uses VoIP VPN 340 to route Caller 322's communication

10   330 from PBX 328 in corporate network 320 to a wireless network Subscriber 390.

11   Those skilled in the art will recognize that communication 330 may also be initiated by a

12   direct telephone call from a home telephone via a telephone company provider or a local

13   central office rather than PBX 328.

14   VoIP VPN 340 includes a CC 344, GW-1 342, GW-2 348, and a Signaling

15   System Seven (SS7) backbone 346. CC 344 includes additional functionality over CC

16   244 of FIG. 2. The CC 344 is where most of the changes for routing occur. The CC 344

17   determines routing steps and instructs GW-1 342 and GW-2 348 how to communicate

18   with each other. The originating exchange (PBX 328 or a CO such as CO 148 of FIG. 1)

19   within the corporate network 320 may use an ISDN Primary Rate Q.931 protocol to route

20   connection 330 to GW-1 342.

21   Wireless network 360 includes an HLR 366 and a VMSC 368. HLR 366, as

22   compared to HLR 166 of FIG. 1, may receive instructions from CC 344, which was

23   prohibited in prior art systems. Wireless network 360 does not include a GMSC 164 as

1 in wireless network 160 because the function of GMSC 164 has been incorporated into

2 VoIP VPN 340. VMSC 368, as compared to VMSC 168 of FIG. 1, receives connections

3 362 from GW-2 348 instead of from the GMSC 164 of system 100. Therefore, this

4 scenario is advantageous over prior systems because, in accordance with the invention,

5 routing does not have to go through a GMSC 164, which is normally fixed at Subscriber

6 390's home base. Further, VoIP VPN 340 maintains control of connections 330, 358,

7 and 362, and can thereby extend additional capabilities. Routing steps associated with

8 system 300 will be discussed in the description of FIG. 4.

9 FIG. 4 is a flowchart illustrating the steps in method 400 that correspond to the

10 routing steps of FIG. 3. In step 410, Caller 322 initiates communication 324 with PBX

11 328 in corporate network 320. In step 415, the originating exchange within the corporate

12 network 320 (PBX 328, or CO 148 as in FIG. 1) determines that communication 324 is

13 an on-net VoIP VPN 340 communication, and thus, routes via connection 330 to GW-1

14 342. In step 420, GW-1 342 via signal path 350 requests routing information from CC

15 344. In step 425, new functionality in CC 344 determines whether the called telephone

16 number of Subscriber 390 is a valid subscribed wireless number, and if so, CC 344

17 determines the characteristics of Subscriber 390's home network (e.g., Electronics

18 Industries Association EIA-41 standard or Global System for Mobile (GSM)

19 communications standard). This functionality provides enhanced VPN call processing.

20 CC 344, via signal path 352, uses SS7 gateway (backbone) 346, which via signal path

21 370 queries HLR 366 for routing information. In step 430, HLR 366 determines whether

22 Subscriber 390 is a valid subscriber, and, if so, queries the serving VMSC 368 for routing

23 information via signal path 372. This is standard wireless routing interrogation. In

1   accordance with the invention, the query to the HLR 366 appears to be from a GMSC

2   (such as GMSC 164 of system 100), and HLR 366 is unaware that the query is instead

3   from CC 344. Policing table(s) in HLR 366 may need to be updated to allow CC 344 to

4   perform the interrogation since most wireless networks restrict this capability to GMSCs

5   within their own network. The invention is thus advantageous over prior art techniques

6   because the invention does not need to use GMSC 164, which is always at the home base

7   of the called subscriber.

8   In step 435, VMSC 368 determines whether Subscriber 390 is registered, and if

9   so, VMSC 368 assigns a temporary routing number N and passes this number N on signal

10   path 374 to HLR 366. In step 440, HLR 366 returns temporary routing number N via

11   signal path 376 through SS7 346, and then via signal path 354, to CC 344 (which HLR

12   366 believes to be a GMSC). In prior art, such as in system 100, HLR 166 returns a

13   temporary routing number N to GMSC 164 instead of to a CC such as CC 344 of system

14   300.

15   In step 445, new functionality in CC 344, based on temporary routing number N,

16   determines the capabilities of the terminating mobile wireless network 360. Existing

17   functionality of CC 344 also determines the identity of GW-2 348 that serves the

18   temporary routing number N and via signal path 355 informs GW-2 348 of the incoming

19   connection 358. In step 450, GW-2 348 via signal path 356 informs CC 344 that GW-2

20   348 is ready to receive connection 358, and in step 455, CC 344 via signal path 357

21   returns instructions and a VoIP IP address to GW-1 342. The instructions are extended to

22   include an indication that routing is to a mobile Subscriber 390 as well as to include the

23   capabilities of the terminating mobile wireless network 360. Steps 445, 450, and 455

1   comprise additional enhancements for Clarent VoIP VPN call processing. Since all the

2   long distance service is provided through the VoIP VPN 340, local connections 330 and

3   362 are the only traditional telecom or telephony links used.

4   In step 460, GW-1 342 establishes connection 358 to GW-2 348. In step 465,

5   GW-2 348 uses temporary routing number N to route connection 362 to VMSC 368. In

6   accordance with the invention, step 465 may involve one or more intermediate exchanges

7   and/or networks. In step 470, VMSC 368 uses standard wireless call processing to

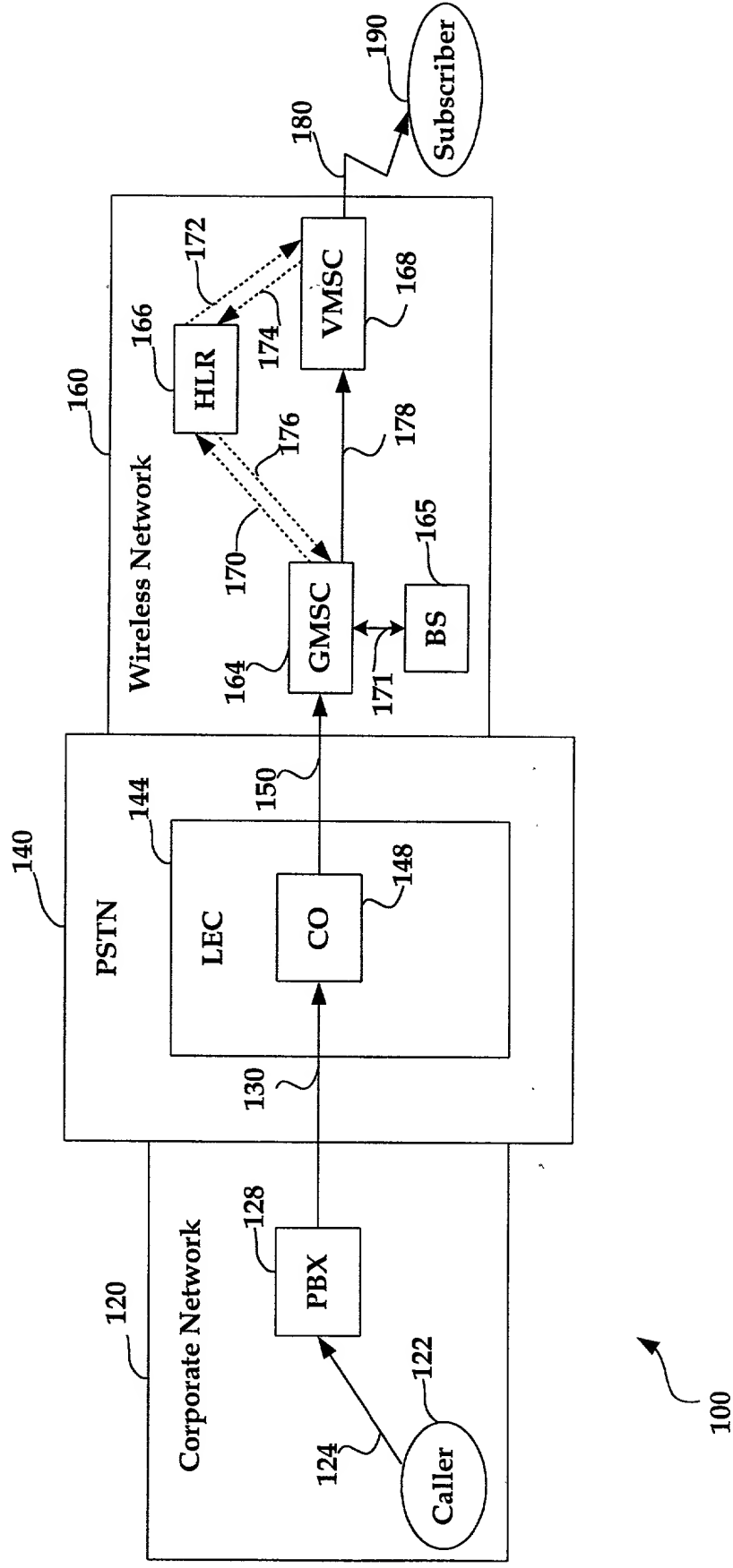8   complete wireless connection 380 to Subscriber 390.

9   In accordance with the invention, method 400 is advantageous over prior art

10   techniques as method 400 efficiently and directly routes to where Subscriber 390 is

11   located, rather than first through a home location for Subscriber 390 and then to

12   Subscriber 390, and thereby incurring toll calls.

13   The invention also provides intelligent call completion services if Subscriber 390

14   is not reachable (e.g., if the phone line is busy or if Subscriber 390's phone is turned off

15   or out of the wireless service area). These services are also applicable to calls

16   terminating to fixed subscribers.

17   While the invention has been described herein with reference to two exemplary

18   embodiments, it is for illustrative purposes only and not intended to be limiting.

19   Therefore, those skilled in the art will recognize that other embodiments can be practiced

20   without departing from the scope and spirit of the claims set forth below.
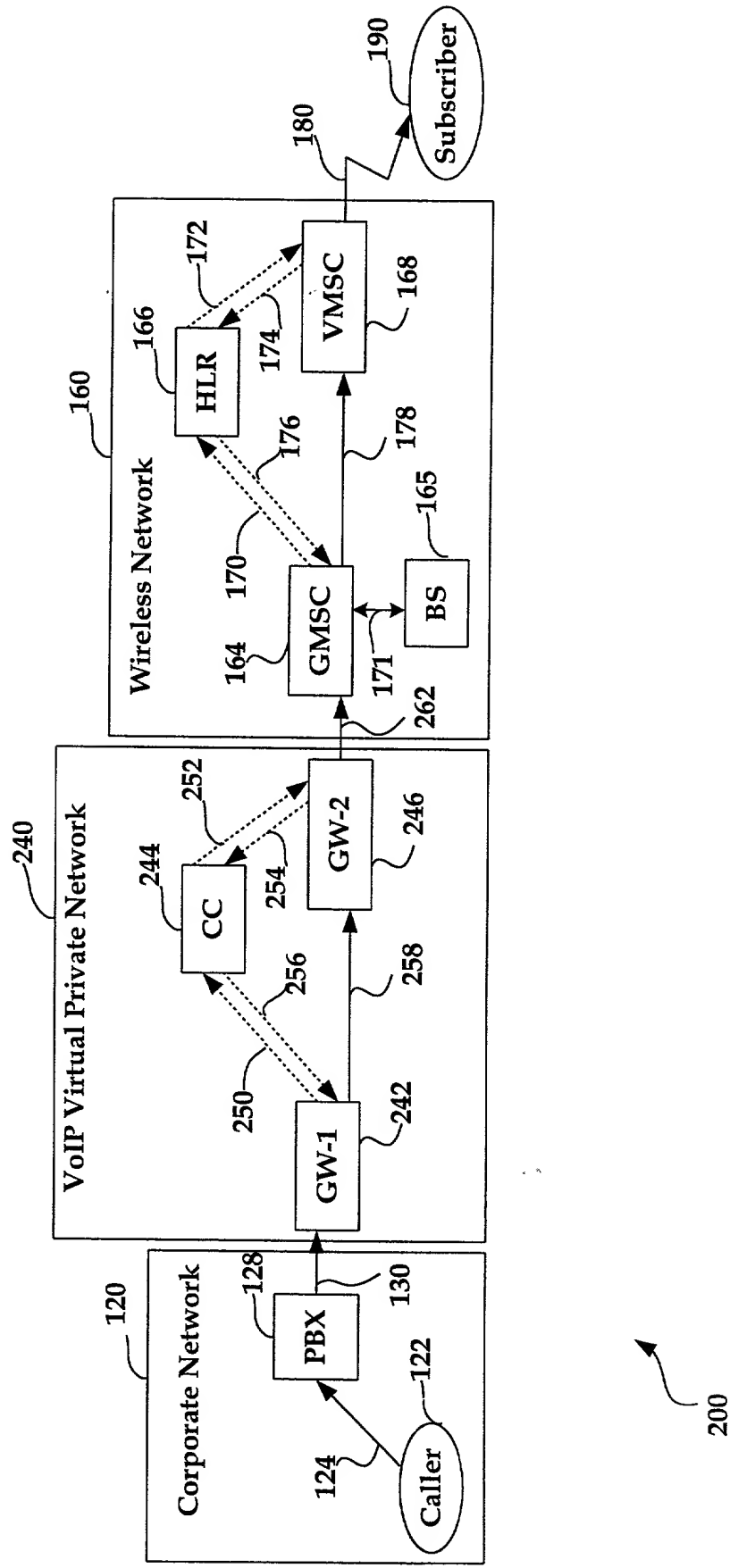
What is claimed is:

1 1. A method of telephonic communication to a wireless Subscriber over Internet Protocol

2 and wireless networks, comprising the steps of:

3   a caller initiating a communication and signal with a PBX or other phone, such as

4 a home telephone connecting to a CO;

5   the PBX or CO routing the signal to a first gateway (GW-1);

6   the first gateway (GW-1) requesting routing information from a Command Center

7 (CC);

8   the CC querying through an SS7 backbone to a Home Location Register (HLR)

9 for routing information;

10   a Visited Mobile (Services) Switching Center (VMSC) assigning a temporary

11 routing number N for the signal and passing the temporary routing number N back to the

12 HLR;

13   the HLR returning the temporary routing number N via SS7 backbone to the CC;

14   the CC informing a second gateway (GW-2) of an incoming connection;

15   the GW-2 informing the CC of its readiness to receive the incoming connection;

16   the CC returning instructions and a VoIP IP address to GW-1;

17   GW-1 establishing the connection to GW-2;

18   GW-2 routing the connection to the VMSC; and

19   the VMSC processing the connection to complete the communication to a

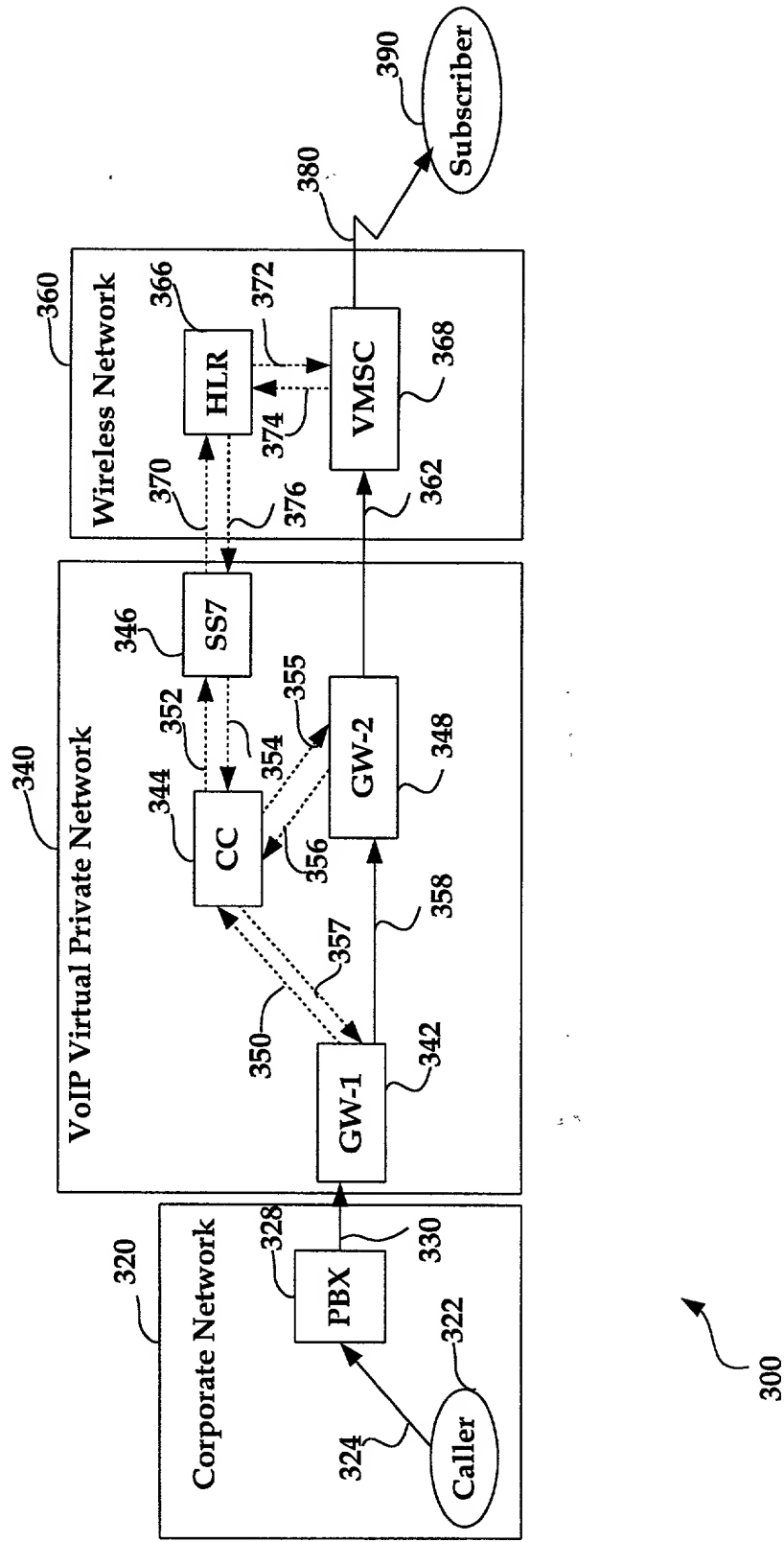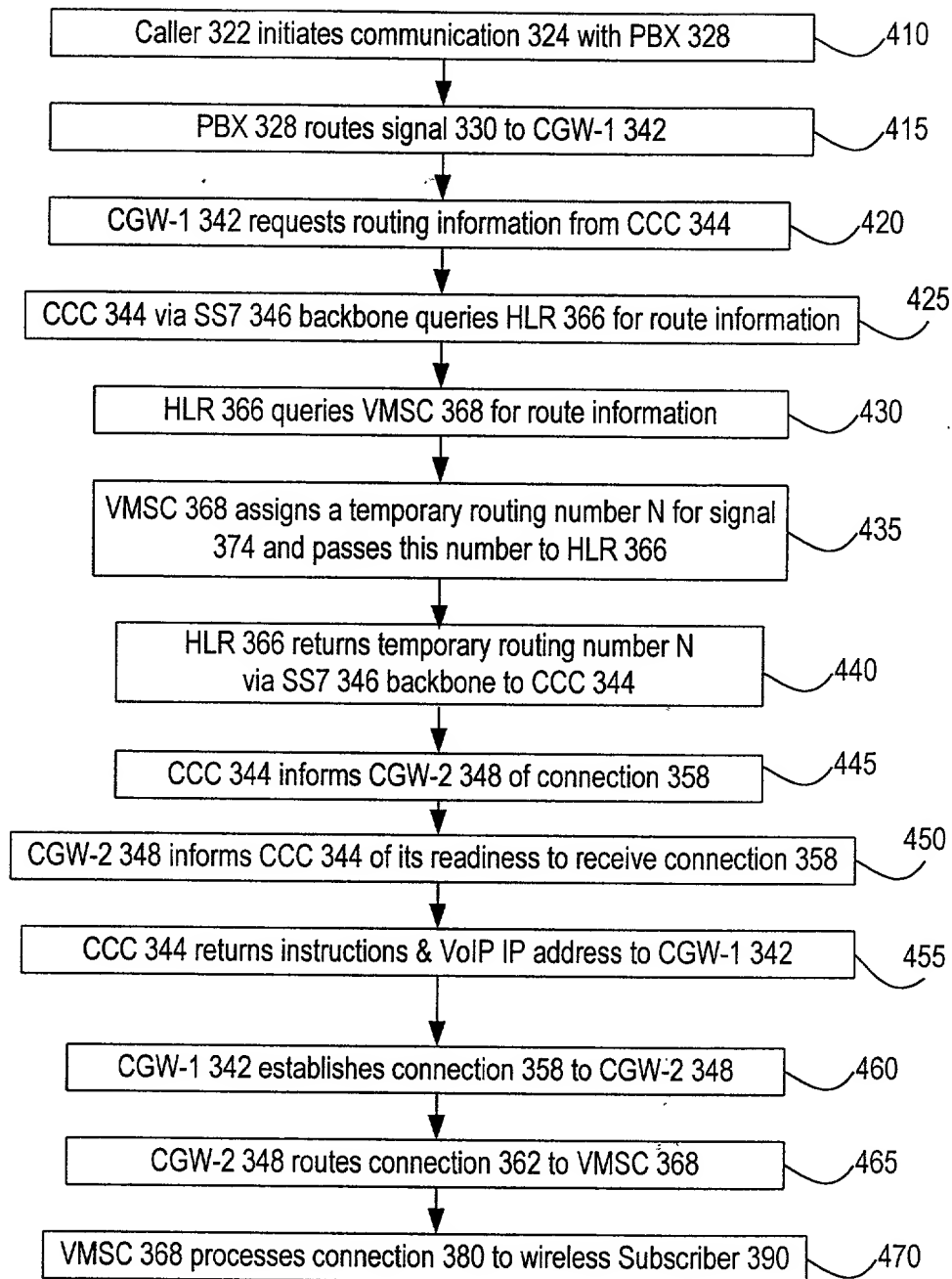20 wireless subscriber.

Prior Art

FIG. 1

Prior Art

FIG. 2

FIG. 3

| Caller 322 initiates communication 324 with PBX 328 | 410 |

↓

| PBX 328 routes signal 330 to CGW-1 342 | 415 |

↓

| CGW-1 342 requests routing information from CCC 344 | 420 |

↓

| CCC 344 via SS7 346 backbone queries HLR 366 for route information | 425 |

↓

| HLR 366 queries VMSC 368 for route information | 430 |

↓

| VMSC 368 assigns a temporary routing number N for signal 374 and passes this number to HLR 366 | 435 |

↓

| HLR 366 returns temporary routing number N via SS7 346 backbone to CCC 344 | 440 |

↓

| CCC 344 informs CGW-2 348 of connection 358 | 445 |

↓

| CGW-2 348 informs CCC 344 of its readiness to receive connection 358 | 450 |

↓

| CCC 344 returns instructions & VoIP IP address to CGW-1 342 | 455 |

↓

| CGW-1 342 establishes connection 358 to CGW-2 348 | 460 |

↓

| CGW-2 348 routes connection 362 to VMSC 368 | 465 |

↓

| VMSC 368 processes connection 380 to wireless Subscriber 390 | 470 |

400

FIG. 4